6. [10 points] The Green Bag Company (GBC) makes hand bags out of recycled materials. A table of the company's marginal cost, MC, and marginal revenue, MR, at various production levels q is given below. The variable q is the number of hand bags produced, and marginal cost and marginal revenue are measured in dollars per bag.

q	1000	2000	3000	4000	5000	6000
MC	100	81	75	96	112	123
MR	125	123	114	110	107	106

Assume for this problem that GBC's cost and revenue functions are twice differentiable and that MC and MR are either increasing or decreasing on each interval shown in the table.

a. [3 points] At which production level from the table is GBC's profit increasing the fastest? Explain your answer.

Solution: The derivative of the profit is $MR - MC$. We are looking for the place where this derivative is largest, so by inspecting the table, we see that $MR - MC$ is largest (with a value of 42) when $q = 2000$ bags.

b. [3 points] The CEO of the company thinks profit is maximized at 3000 bags, but the CFO of the company thinks that profit will be maximized at 4500 bags. Who could be correct, and why? [Note: The terms "CEO" and "CFO" refer to officers in the company.]

Solution: The CFO could be correct because the profit will be maximized when $MC = MR$ and this *could* occur at $q = 4500$ since $MR - MC$ changes sign somewhere in the interval $4000 < q < 5000$. It definitively does not occur at $q = 3000$ because $MR > MC$ at this point which means producing more bags will result in higher profits for the company.

c. [4 points] Assuming GBC has no fixed costs, use a right-hand sum to estimate the cost to produce the first 3000 bags. Be sure to show your work.

Solution: Doing a right hand sum, we have

$$C(3000) = \int_0^{3000} MC(q)dq \approx 1000MC(1000)+1000MC(2000)+1000MC(3000) = 256000.$$

So the approximation predicts the cost to produce the first 3000 bags will be \$256,000.